Title: Let's Go Fly a Kite!

Brief Overview:

> This performance task actively involves students individually and in pairs in designing and constructing a kite. Through the course of this unit, they will construct and use tangrams, and read, write, and follow directions. They will calculate perimeter and area, create a repeating pattern, and apply computational and measurement skills. They also will use writing to communicate mathematically.

Links to NCTM Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics, including problems with open-ended answers and problems which are solved in a cooperative atmosphere.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and within other disciplines.

- **Number Sense and Numeration**
  Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose appropriate operations and describe effects of operations on numbers.

- **Whole Number Computation**
  Students will demonstrate their ability to solve problems using arithmetic operations. They will determine reasonableness of solutions.

- **Geometry and Spatial Sense**
  Students will demonstrate their ability to describe and apply geometric relationships using one, two, and three dimensional objects. They will demonstrate congruency, similarity, symmetry, and reflections and apply these concepts to the solution of geometric problems.

- **Measurement**
  Students will demonstrate and apply concepts of measurement using non-standard and standard units and metric and customary units. They will estimate and verify measurements. They will apply measurement to interdisciplinary and real-world problem-solving situations.

- **Patterns and Relationships**
  Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data.

Grade/Level:

Grades 3-5

Duration/Length:

Activities 1-3 will each take approximately 60 minutes.
Activity 4 will take three class periods of approximately 60 minutes each.

Prerequisite Knowledge:

Students should have working knowledge of the following:

- Polygons
- Use of scale
- Perimeter and area
- Symmetry, congruency
- Patterns
- Regular intervals
- Standard measurement

Objectives:

Students will:

- read to perform a task (make their own set of tangrams).
- use tangrams to recreate pictures, create original pictures, and form polygons.
- complete a chart.
- write and revise directions.
- work independently and in pairs.
- use scale.
- calculate perimeter and area.
- identify symmetrical shapes.
- communicate mathematically using words and number sentences.
- create a repeating pattern.

Materials/Resources:

- <u>Grandfather Tang's Story</u> by Ann Tompert, 1990 (task can be completed even if this book is unavailable)
- Oaktag
- Scissors
- Yarn or string
- Glue
- Standard rulers
- Calculators
- Crayons, colored pencils, or markers
- Dowel rods or sticks
- Bulletin board paper
- Construction paper
- Tape
- Fabric pieces
- Ribbon
- Individual copies of student booklets
- Individual copies of student resource pages

Development/Procedures:

Activity 1:

- Read <u>Grandfather Tang's Story</u> by Ann Tompert to class.
- Students read directions to perform task of making own tangram set (see Resource 1).
- Students work independently to create animals from the story using their tangrams (see Resource 2a-2d).

Activity 2:

- Challenge students to reconstruct the original square using all of their tangram pieces (see Resource 2e).
- Assign student pairs to form polygons with tangram pieces and complete chart (see Resource 3). For younger students, you may wish to enlarge chart so they can trace around the pieces.

Activity 3:

- Give oral directions to the class that they will follow using their tangrams to recreate one of the animal pictures from Resource 2. Do not tell students which animal you are describing.

Use math and directional vocabulary such as triangle, square, vertex, midpoint, hypotenuse. Example: Place the large triangle on your desk so that the hypotenuse is towards you. Place the square against the bottom of the triangle so that it reaches from the midpoint of the hypotenuse to the vertex on the right.

- Students create an original picture using tangrams, then write directions that could be followed by someone to recreate their design (as in previous step).
- Pair students. One student reads his own directions aloud to partner as he/she tries to recreate design. "Authors" revise their written directions as they see the need. Partners switch roles. You may then want to reassign pairs and have them see if their revised directions help a new partner to be more successful in completing the tangram picture.

Activity 4:

- Give students each a 12 inch piece of yarn or string and a sheet of blank paper. Direct them to use these materials and their tangrams to create a kite with a tail. They should glue the yarn/string to the paper and trace around the tangrams. Color if desired and display to compare results.
- Distribute "Let's Go Fly a Kite" booklet to each student. Completion of entire booklet will take 2-3 class periods of about 60 minutes each. Determine which steps in booklet you wish to have them complete each day. Provide time and materials as needed. Allow calculator use throughout task. It would be possible to eliminate step 5 (actual construction of kites) if you prefer.

Performance Assessment:

This unit provides on-going assessment through performance-based instruction. The teacher will assess the students informally using observation and questioning throughout Activities 1, 2, and 3. A scoring rubric for Activity 4, the student booklet, has been provided (see Resource 4).

Extension/Follow-Up:

- Write an invitation to invite parents to Children's Day.
- Use protractors to measure the angles of the kites.
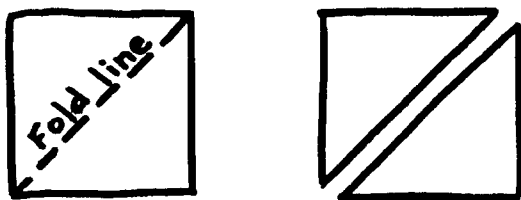- Integrate learning unit with study of Japan.

Authors

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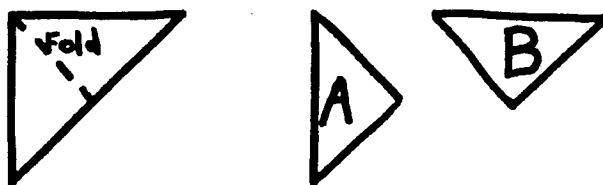Cecil County, MD

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# Make Your Own Tangram Pieces

1.   Begin with a 4 in. square piece of oaktag. Fold the square on the diagonal. Unfold and cut to make two congruent triangles.

2.   Fold one triangle in half. Unfold and cut to make two congruent triangles. Label them A and B.


3.   Take your large triangle and fold it in half. Unfold. Fold the vertex of the right angle to the midpoint of the opposite side (hypotenuse). Unfold. Cut on second fold, as shown below. Label small triangle C.
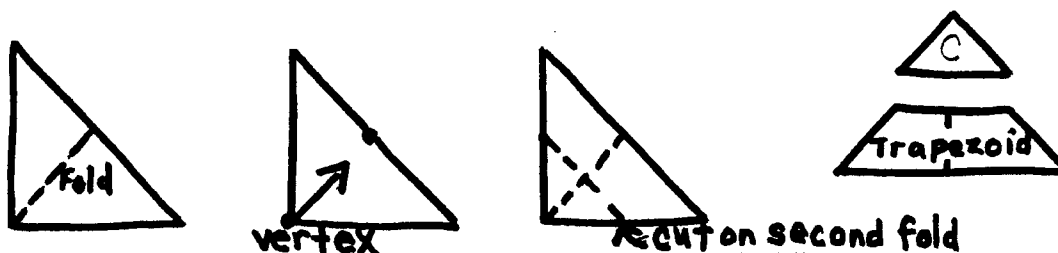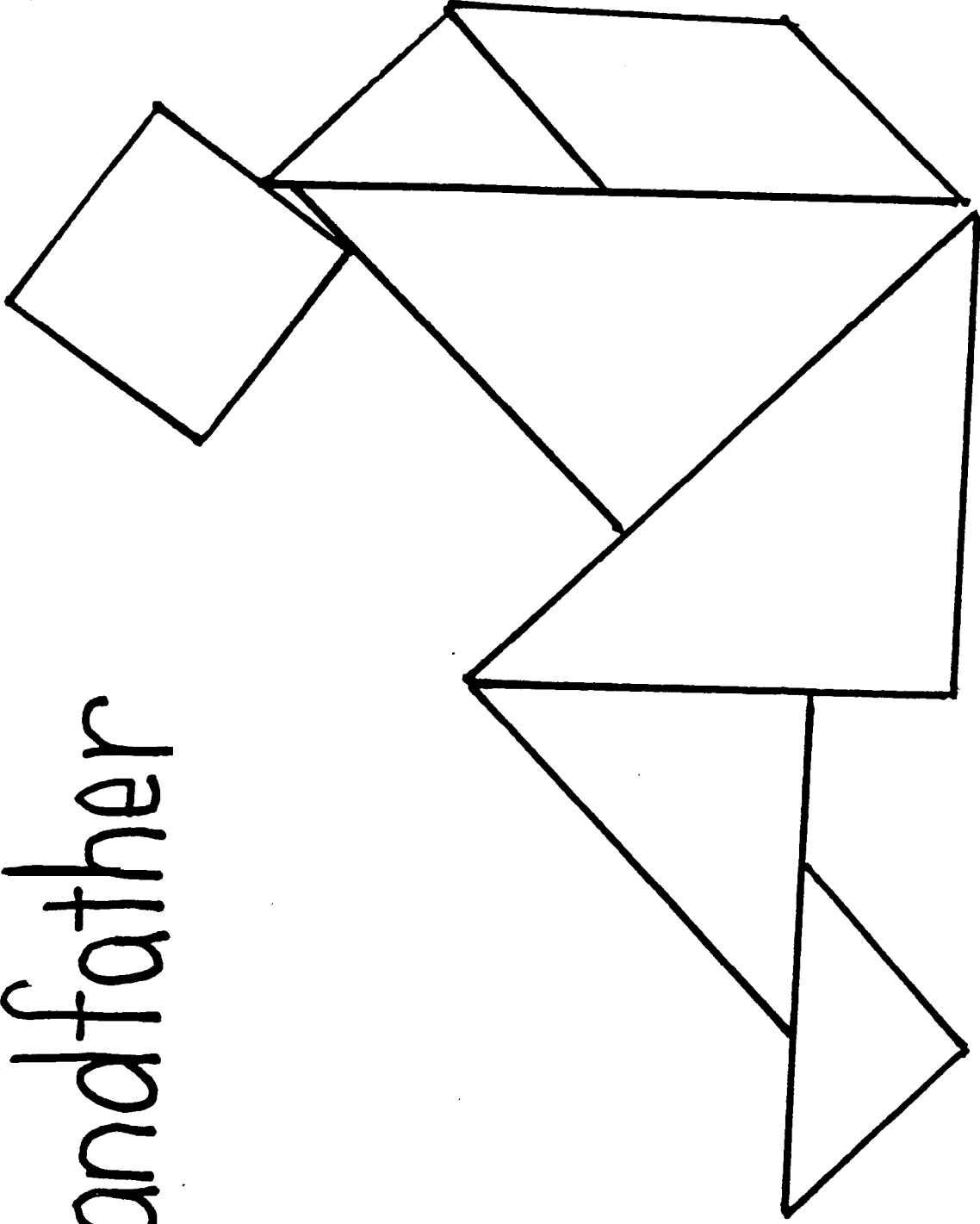

4.   Take the trapezoid that you cut away from the triangle C. Cut on fold line. Take remaining two pieces and fold, then cut on lines as shown on diagram below. Label the parallelogram D, one triangle E, one triangle F, and label the square G.
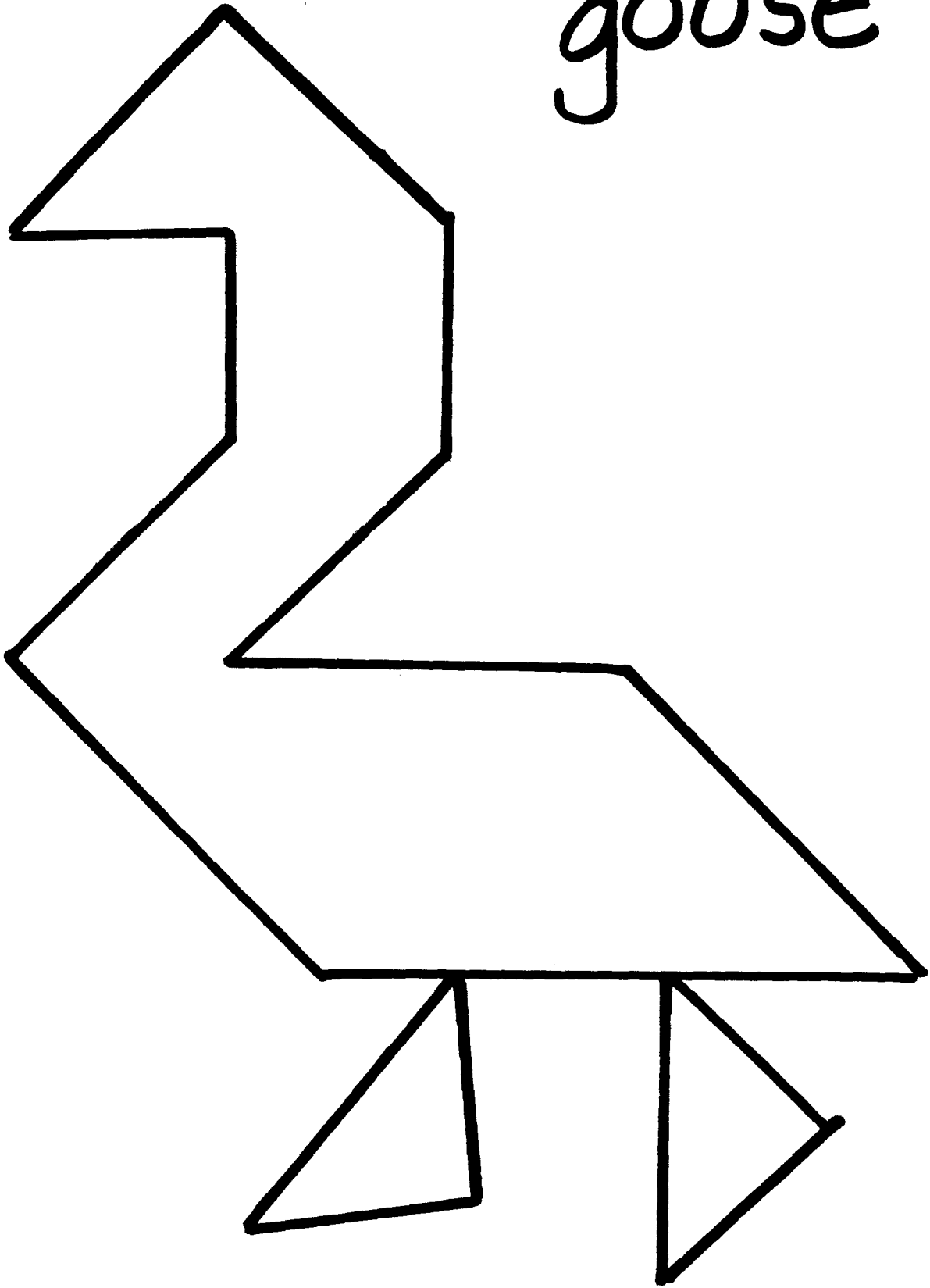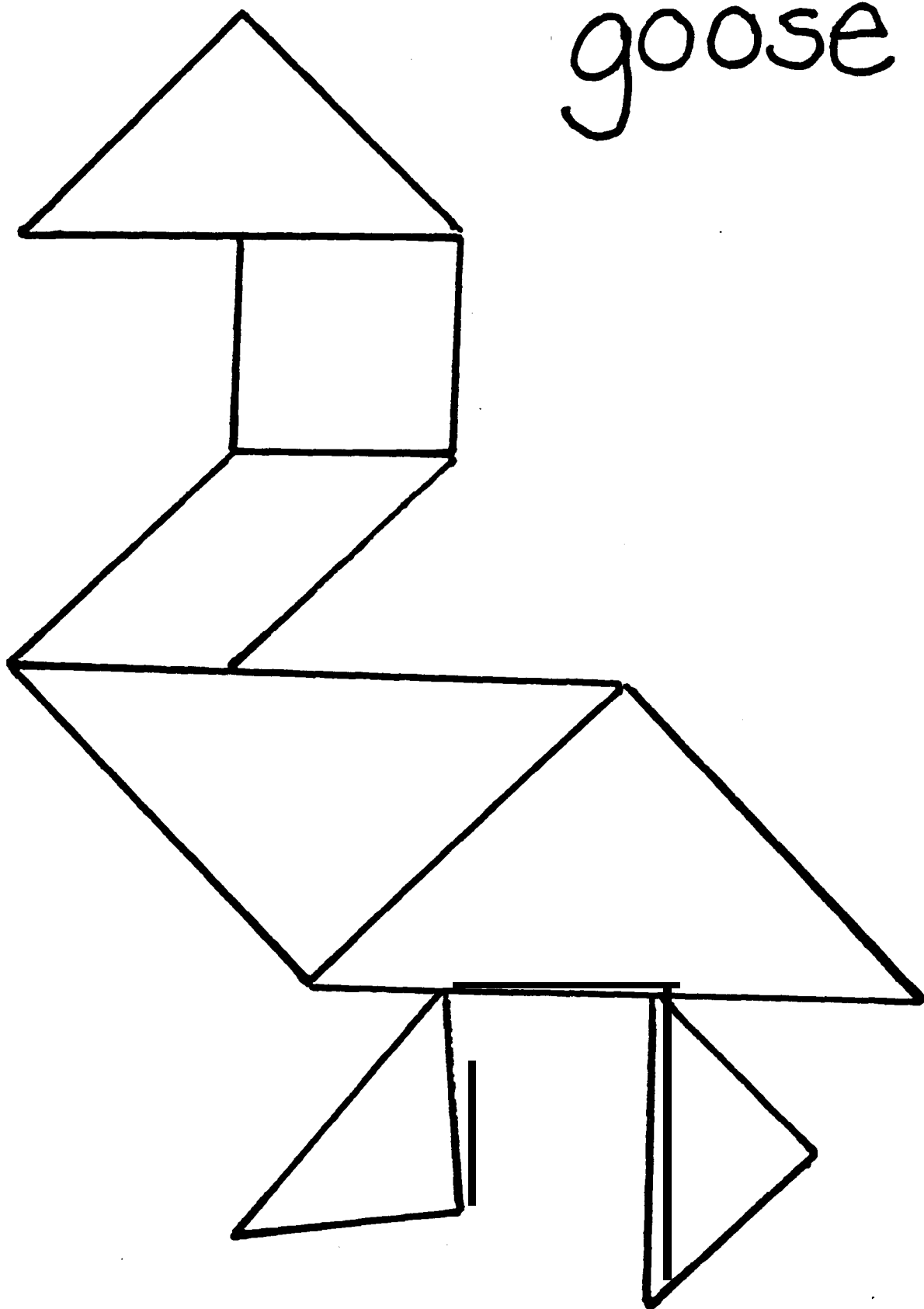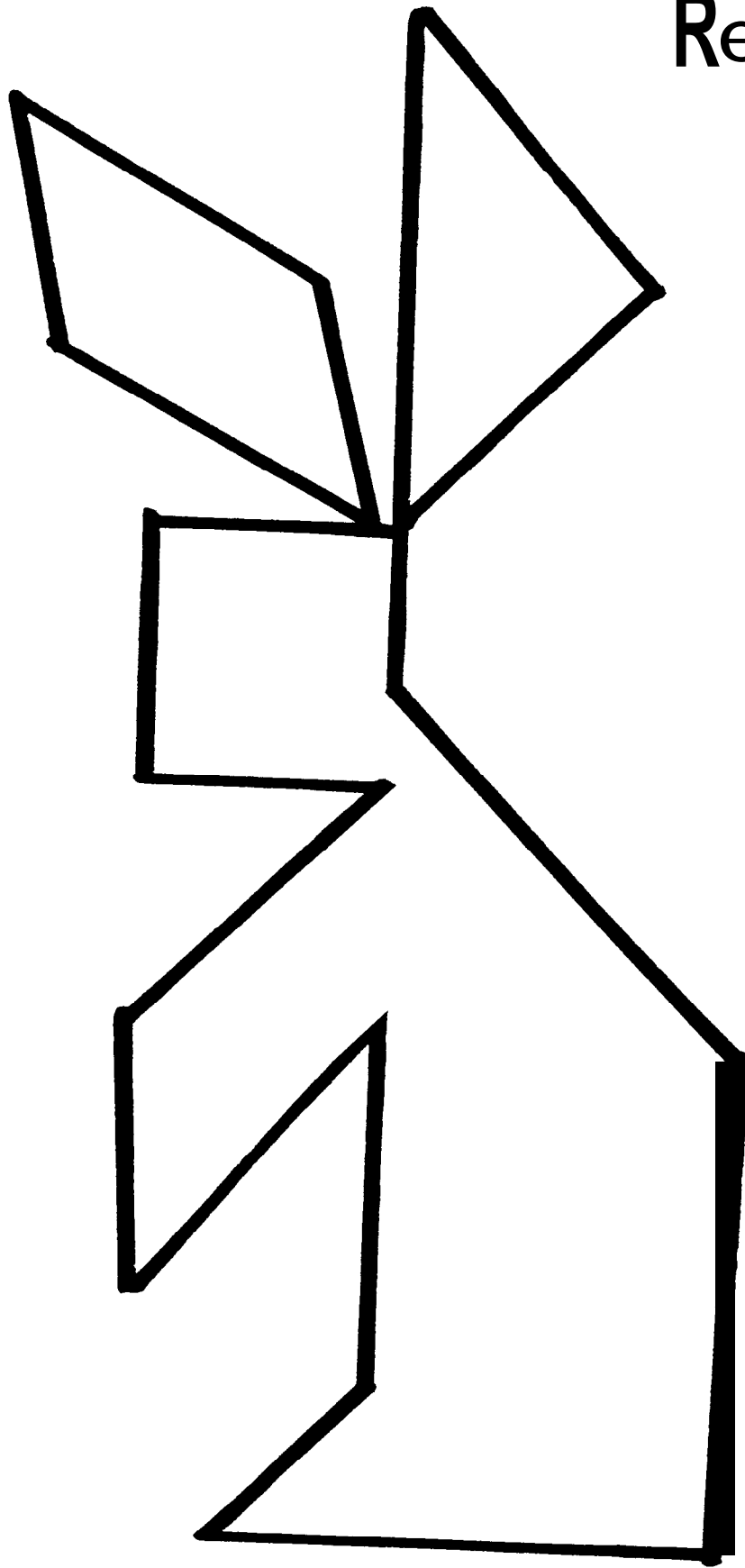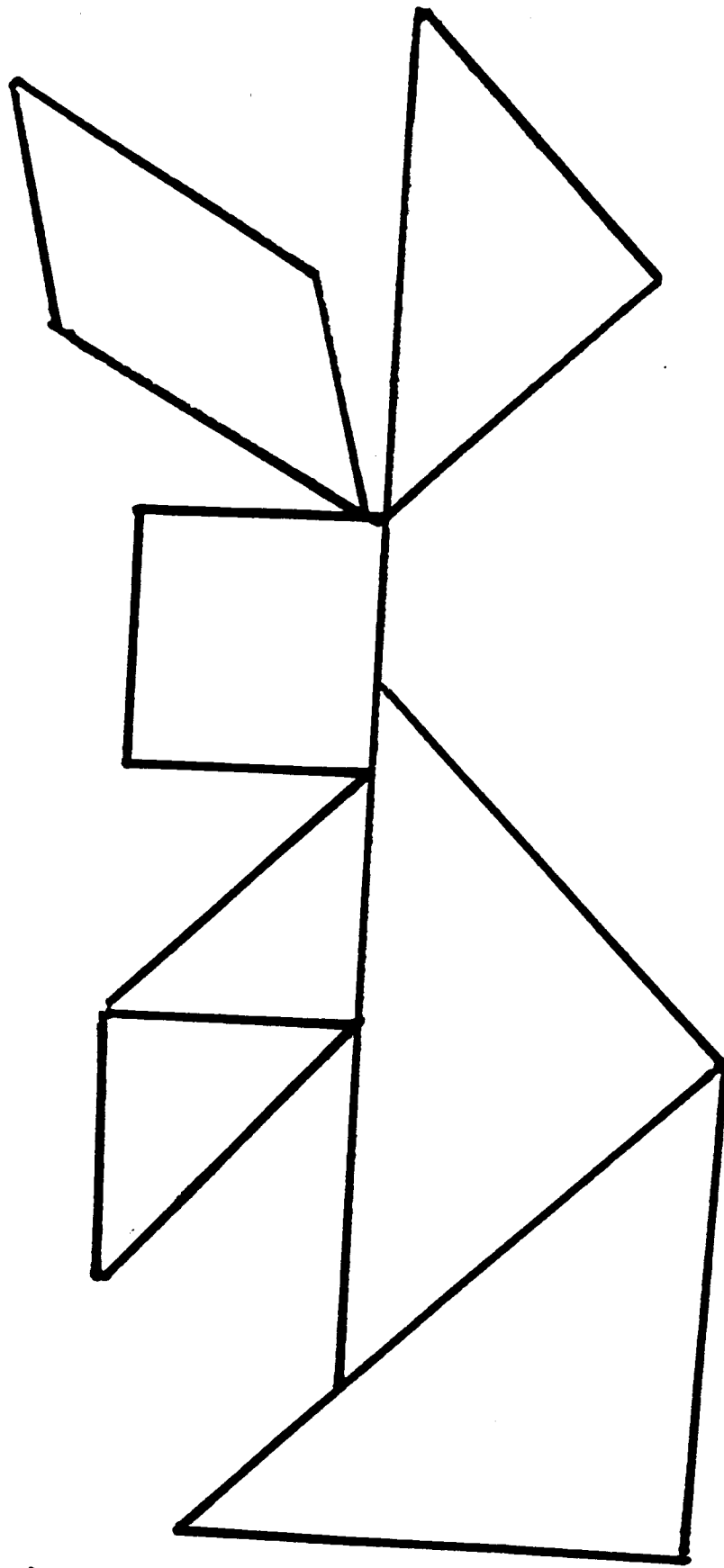
Grandfather
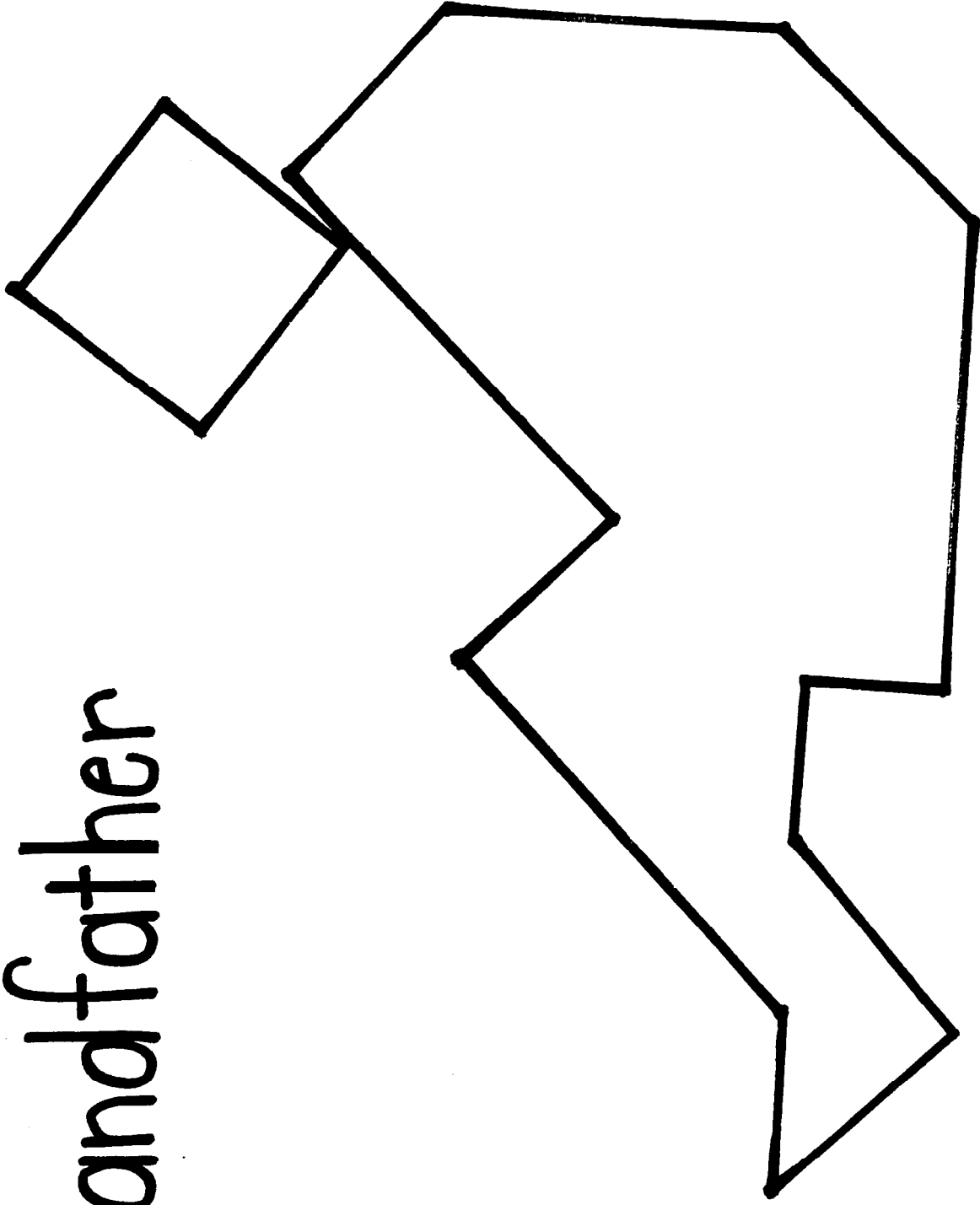
Grandfather

goose

goose

rabbit

rabbit

fox
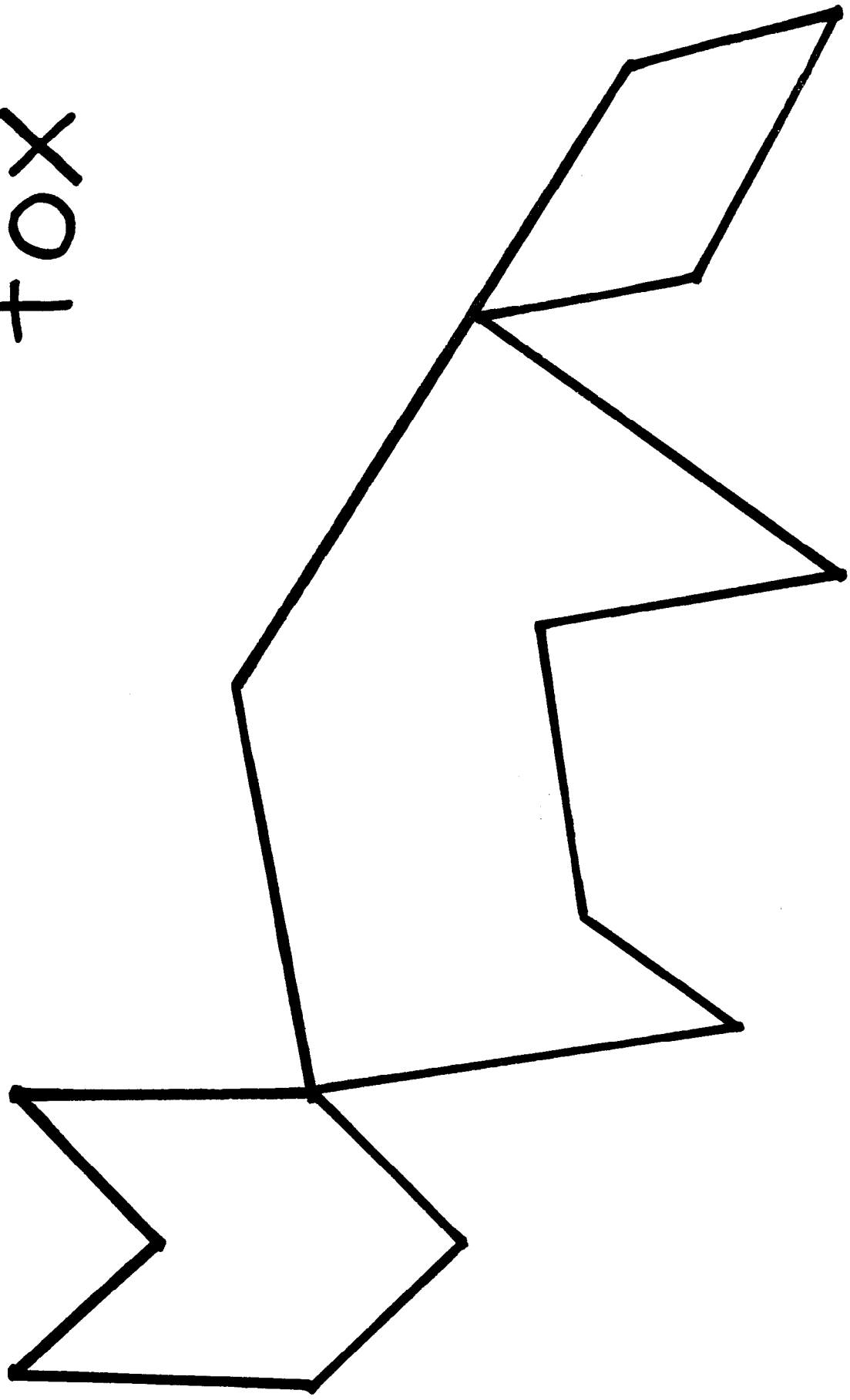
fox
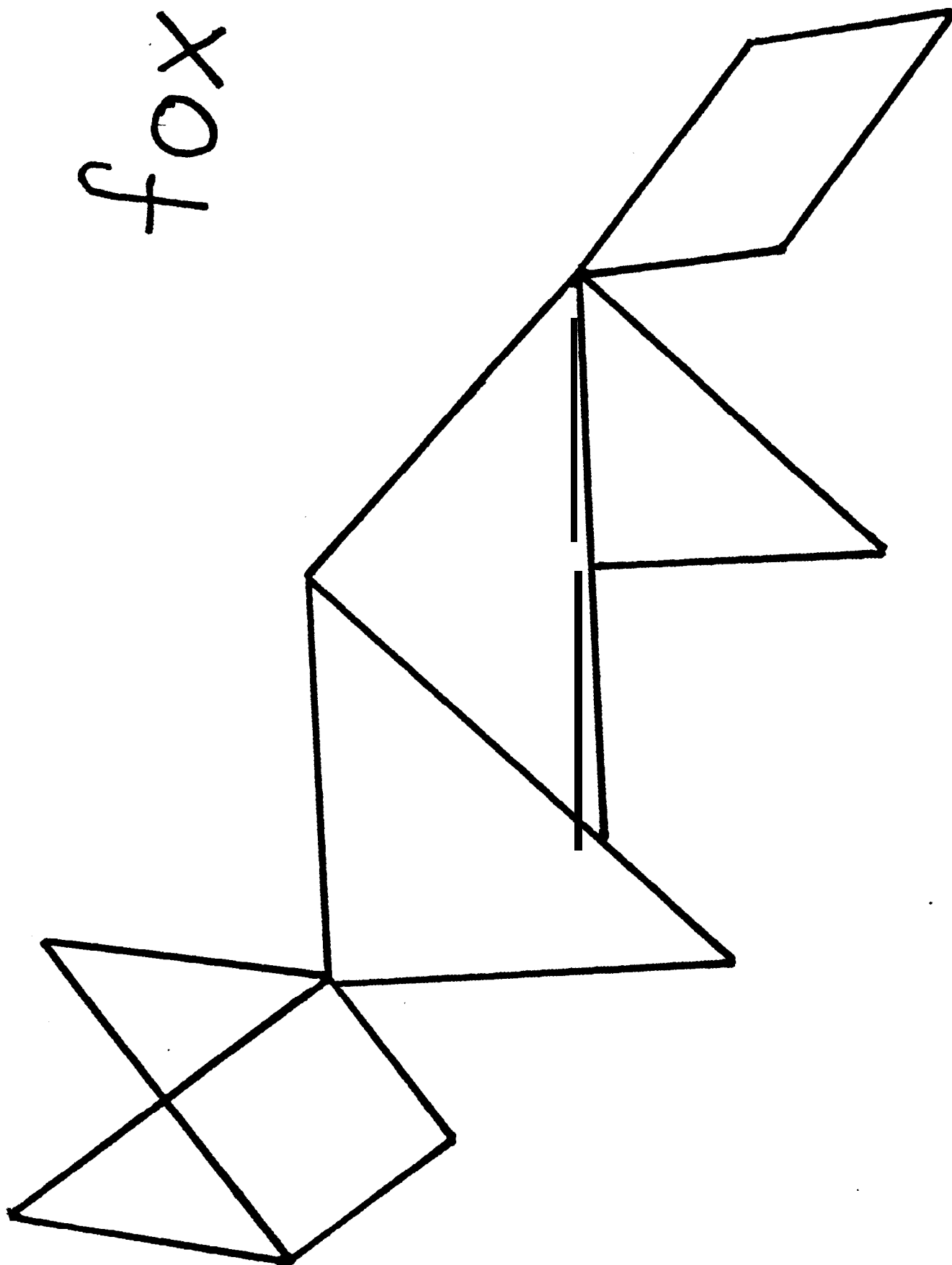
Solution to Tangram Puzzle
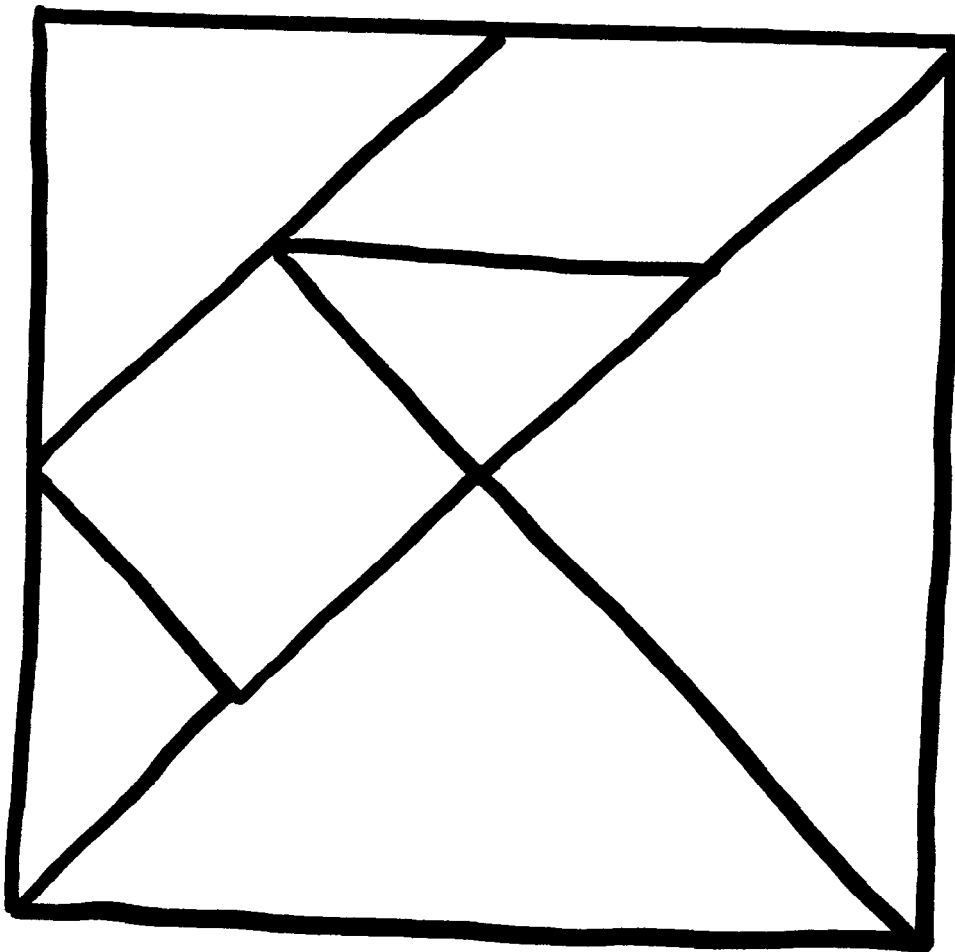
Name_____

Use your tangram pieces to construct squares, triangles, rectangles, and parallelograms with the number of pieces shown on the chart. After you have successfully solved the puzzles, draw your solutions in the correct boxes to complete the chart.

Number of Tangram Pieces	Square	Triangle	Rectangle	Parallelogram
3 pieces				
4 pieces				
5 pieces				
6 pieces				

Let's Go Fly a Kite!
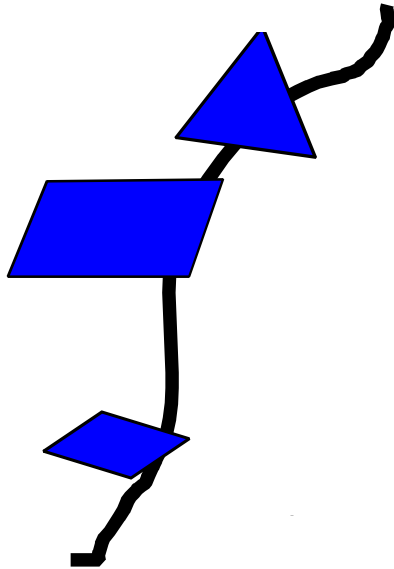
Student Booklet

Name_____

May 5 in Japan is Children's Day, known as Kodomo-no-hi. It is a national holiday that is celebrated by both boys and girls. Flying kites is the highlight of the day. We are going to be celebrating Children's Day at school. You and your partner will design and construct a kite to fly on this special day.
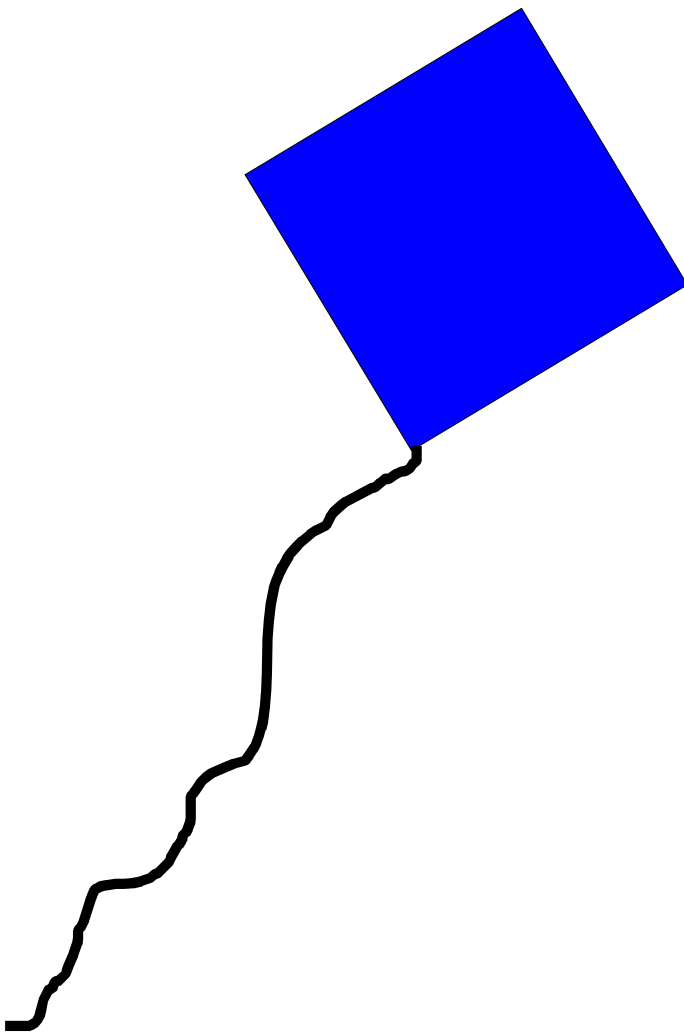
Step 1

You will create a kite that measures 35 in. long by 20 in. wide.   In the space below, make a sketch of this kite using a scale of 1 in. = 5 in.

My drawing is_____ in. long and _____ in. wide.

Step 2

Find the perimeter of your drawn kite.

_____

Explain how you calculated your answer using words and a number sentence.

_____

_____

_____

_____

What would the perimeter of the actual kite be? (Remember your scale is 1 in. = 5 in.)

_____

Explain how you calculated your answer using words and a number sentence.

_____

_____

_____

_____

Is your kite symmetrical?

_____

Explain your answer.

_____

_____

_____

Step 3

     Now it is time to make a design for the border of your kite. You must create a repeating pattern using at least three different geometric shapes. You may use two or three diierent colors in your pattern. Create your border using the diagram below.

Describe your pattern.

_____

_____

_____

_____

_____

_____

Step 4

We need to divide our playground into sections for each grade level for Children's Day. One student, Zann, suggested the plan below. Some students did not think the playground was divided fairly.

Zann's Plan

a. Calculate the area for each section on the playground and record in the chart below.

Grade	Area in Square Units
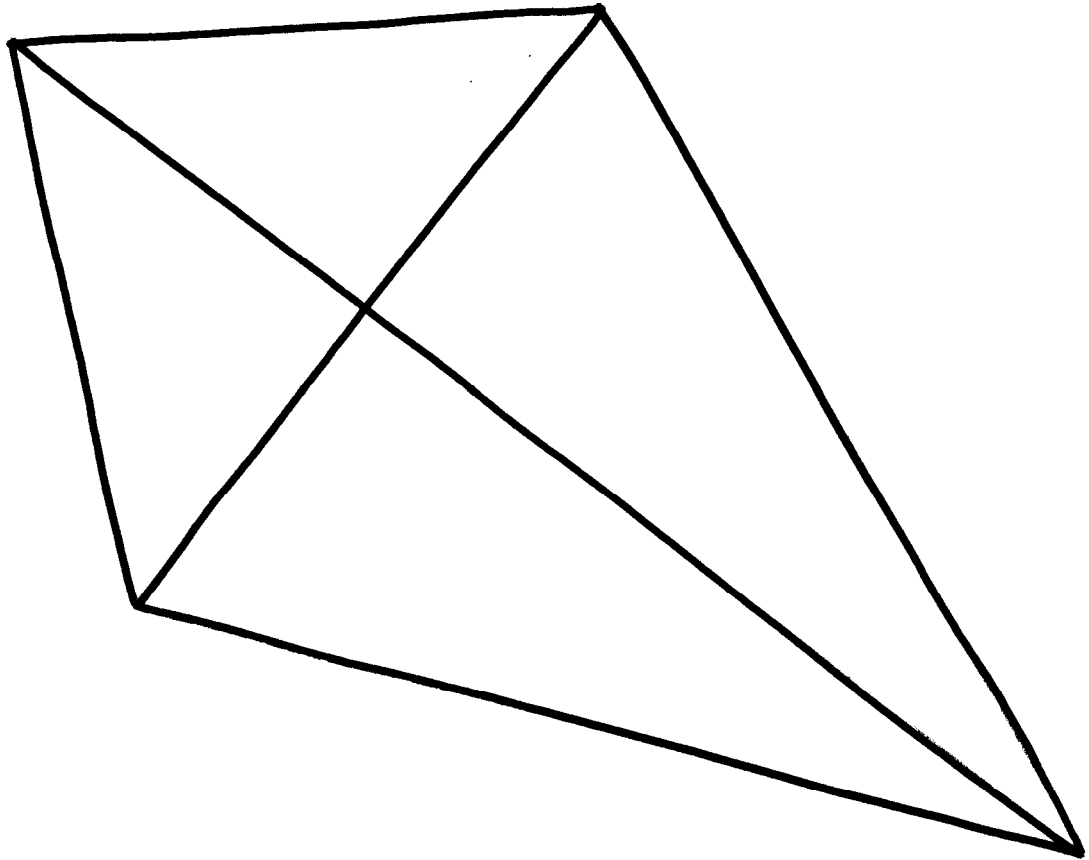
b. Explain how you calculated area for Grade 2.

_____

_____

_____

_____

_____

_____

c. Do you agree that Zann's plan is not a fair division?   Explain your answer.

_____

_____

_____

_____

_____

d. What is the total area of space on the playground?   How much area should be given to each grade level if each receives an equal amount? Explain your answers using words or number sentences.

_____

_____

_____

_____

_____

e. On the grid below, draw a new plan to assign an equal area to each grade.
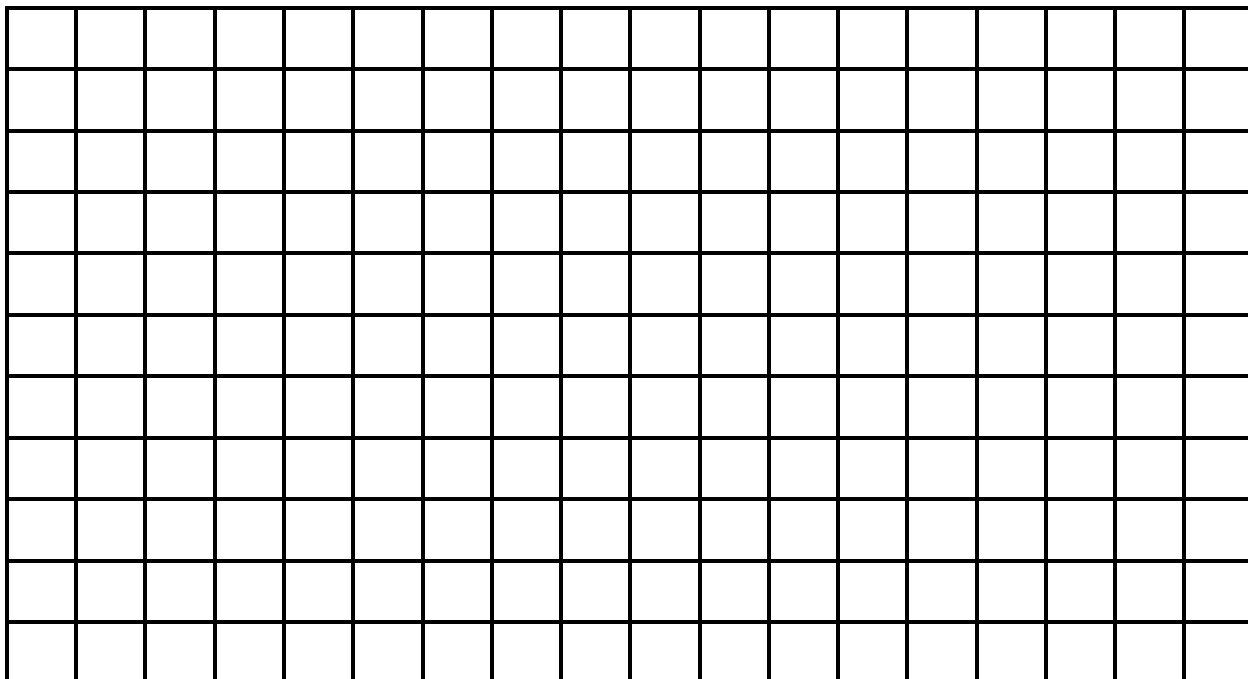
Step 5

You and your partner will be working together to construct one kite. Your kite must have a tail that is 72 in. long. Your kite's tail must have 6 fabric pieces tied on it at regular intervals. Work with your partner to write a number sentence to show how far apart the fabric pieces must be. (Remember you will both need to write the number sentence in your booklet.)

_____

Now you need to make a decision on whose kite design you will use to construct a kite. You will have 5 minutes to talk with your partner and complete parts a and b below.

a. Whose kite design did you choose?

_____

b. Explain your decision.

_____

_____

_____

_____

Now you are ready to construct your kite for Children's Day. Remember it must be 35 in. by 20 in. You also need to refer to Step 3 and follow your plan for the kite's border and tail. Materials will be provided in the classroom.

Scoring Rubric for Student Booklet
15 possible points

Step 1:

    2--calculations are correct and kite drawing measures 7 inches long
      by 4 inches wide.

    1--either calculations OR kite drawing is incorrect.

    0--calculations and drawing are incorrect.

Step 2:

    3--answers are correct and labeled (16-18 in.; 80-90 in.).
      explanations are clear and complete.
      accurate number sentences are included.

    2--at least 2 answers are correct AND at least 2 explanations are
      clear and complete.

    1--at least 1 answer is correct AND at least 1 explanation is clear
      and complete.

    0--most answers are incorrect AND explanations are unclear.

Step 3:

    3--repeating pattern is shown along border.
      at least 3 different shapes are used.
      either 2 or 3 colors are used.
      description of pattern is excellent and complete.

    2--repeating pattern is shown along border.
      either shape or color directions were not followed.
      good description of pattern.

    1--pattern meets criteria for a 3, but description is poor.
               OR
      pattern criteria was not followed but description is good.

0--pattern incorrectly completed AND description is poor.

Step 4:

Part A:
2--5 or 6 areas correctly calculated (K=30 sq.units; 1=24 sq.units; 2=51 sq.units; 3=21 sq.units; 4=42 sq.units; 5=30 sq.units).

1--3 or 4 areas correctly calculated.

0--fewer than 3 areas correctly calculated.

Part B:
2--explanation is accurate and complete.

1--explanation shows understanding of concept, but is incorrect .

0--explanation is inaccurate and unclear.

Part C: This section is not scored.

Part D:
2--total area calculated as 198 square units.
   area per grade level calculated as 33 square units.
   explanation is clear and complete.

1--both calculations are correct, but explanation is poor.
                    OR
   only one calculation is correct and explanation shows
   some understanding of process.

0--incorrect calculations and poor explanations.

Part E: This section is not scored.

Step 5:

1--accurate number sentence indicates 12 inches between pieces.

0--number sentence is inaccurate.